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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/853,125	05/09/2001	Gary B. Hughes	00W088	5219

7590 03/08/2004

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EXAMINER	
KOCH, GEORGE R	

ART UNIT	PAPER NUMBER
1734	

DATE MAILED: 03/08/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/853,125	HUGHES ET AL.	
	Examiner	Art Unit	
	George R. Koch III	1734	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 November 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Salatino (US Patent 5,887,343), Schar (US Patent 5,842,273), Chiu (US Patent 5,849, 132) and Sato (US Patent 5,985,064).

As to claim 1 and 11, Salatino discloses a method of fabricating comprising the steps of providing a sensor chip assembly and mounting platform (items 20 and 30), positioning the sensor chip in facing by spaced apart relation to the mounting platform (see, for example, figure 4), and placing a bonding medium between the sensor chip assembly and the mounting platform (item 40). Salatino discloses that the bonding medium comprises at least two malleable particles (items 37 and 38), and a quantity of uncured adhesive (see column 4, lines 30-40, which describe the film as being a thermoplastic transparent film - uncured adhesive comprises thermoplastic materials). Particles 37 and 38 are clearly intended to be spherical : note that one circular element 37 mates with each pair of the square elements of 21 and 31 (see all figures), and are positioned in the thermoplastic. Salatino discloses bonding the sensor chip to the mounting platform (see column 4, lines 44-46, which discloses bonding the sensor chip to the mounting platform). Salatino is silent as to the apparatus that bonds the two structures together, except to mention that the apparatus is a convention DCA (direct chip attachment) device (column 4, lines 46-50), and that any conventional DCA apparatus is intended to be used for the creation of the sensor chip assembly. Salatino also discloses that the heating occurs after the joining, i.e. pressing steps (see either Figure 1 or Figure 9. In Figure 1, pressing/joining occurs at step 14 and heating occurs afterwards at step 15. Similarly, in Figure 9, pressing joining occurs at step 63 and

heating occurs at step 64. In both flowcharts there is a preliminary heating step that occurs prior to the joining of the sensor and the platform - however, this heating steps attaches the film to the sensor, and occurs prior to any joining of the sensor and platform, and this step is not excluded by the current claimed method).

Salatino can be interpreted as being silent as to the shape of the malleable spheres, whether the material used is a metal that bonds to both components when subjected to sufficiently large force, the type of material used for the malleable spheres, and the specific steps and details of using the bonding apparatus (i.e., does not disclose the bonding apparatus in detail with the steps of monitoring, controlling, and curing.) Furthermore, Salatino discloses only as a preferred embodiment as using thermoplastic adhesives, which do not cure under heat. However, Salatino does disclose that the thermoplastic can be replaced by other known materials (see columm 4, lines 7-10 and lines 30-40).

Schar discloses that it is known to use a thermoset with the metal malleable spheres. Schar discloses several curable adhesives such as silicones (see column 5, lines 47-64). Schar also discloses curing the metal-thermoset combination after the bonding stage, and suggests that this can be done in order to provide the capability to subsequently repair the substrates (column 3, lines 59-65). One in the art would appreciate that this thermoplastic can replace the thermoplastic of Salatino if a more permanent, cured bond is desired, that is less vulnerable to subsequent heat. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized a thermoset adhesive which would cure instead of simply heat

under the heating phases in order to achieve a bond that is not vulnerable to misalignment if subsequently subjected to heat. Furthermore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have used a subsequent cure step in order to provide a repair capability prior to final curing.

Chiu discloses a bonding method for semiconductor bonding wherein malleable spheres are used, and the spheres are made of gold. Chiu uses these gold spheres in a sphere and adhesive bonding layer (see Figures 2a-2e). Chiu discloses that gold is particularly useful for making contacts to aluminum contacts on a semiconductor chip. Chiu also discloses that the gold spheres are positioned in the adhesive mix. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized gold spheres as the contact material in order to make highly efficient conductive pathways on conventional aluminum contacts.

Sato discloses a conventional DCA apparatus for apply a chip to a platform. Sato discloses pressing the first element into the second element, with sufficient force to bond the bonding material such that the two elements are bonded. Sato also discloses monitoring the forces of the bonding reaction and controlling the force of the bonding apparatus responsive to the monitoring. Sato discloses a load sensor (item 33) which is operable to control the reaction force, i.e., compression force (see column 4, lines 15-30). This load sensor feeds back information which controls the compression force. One in the art would appreciate that Sato would fit as the conventional DCA apparatus recited in Salatino, and further includes benefits of controlling the pressing function in order to properly bond the article. Therefore, it would have been obvious to one of

ordinary skill in the art at the time of the invention to have utilized the bonding apparatus and control methods for generalized semiconductor component bonding as in Sato with the overall sensor assembly bonding method and article of Salatino in order to properly control the joining step of Salatino which occurs prior to curing the adhesive.

Claims 1 and 11 are rejected on similar grounds as claim 20 above.

As to claim 2 and 12, Sato discloses the claimed bonding apparatus operating steps (as noted above in the rejection of claim 1 and 11 - and see also element 61 and other control structures) which provides the limitations.

As to claims 3 and 13, Sato evaluates the stresses or loads (via the load sensor) applied and selects the stress limitations responsive to the step of evaluating the stresses. It is understood in the art of chip and die bonding that stress monitoring is done for among other reasons, to primarily avoid damaging the final product.

As to claim 4, Salatino, Schar, Chiu and Sato as applied to claim 1 and 11 above discloses the claimed step. Note that in both Salatino and Chiu, the first component and second component are at some point positioned in a facing relationship. Also, as to the adhesive/electrical partical mix, both Salatino and Chiu disclose as applied in claim 20 above that adhesive is dispensed between the first and second component, and that the spheres are positioned in the adhesive, the two components are brought into touching contact with each other, and joined. Salatino discloses that the first and second component are joined by a DCA apparatus, and Sato, a typical DCA apparatus discloses that it is known to use force in the joining.

As to claim 5 and 14, Sato discloses determining the load or stresses placed on the component. Such a set of loads or stresses would include determining the maximum stress.

As to claim 6, 7, 15 and 16, Salatino discloses that a sensor chip is the first component, and a mounting platform is the second component.

As to claim 8 and 17, Sato discloses a typical load profile (see Figure 3).

As to claims 9 and 18, Chiu discloses the use of gold spheres (see rejection of claim 20 above)

As to claim 10 and 19, Salatino as applied to claim 1 and 11 above discloses joining, and then heating. Therefore, the joining force is removed before the heating or full curing of the adhesive. Furthermore, while Sato does not disclose removing the assembly, such a step is obvious in order to create the next assembly, since the apparatus is intended to make more than one assembly.

5. Claims 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Salatino (US Patent 5,887,343), Schar (US Patent 5,842,273), Chiu (US Patent 5,849, 132), Sato (US Patent 5,985,064) as applied above and further in view of Freeman (US Patent 5,234,530).

As previously recited above, Salatino discloses a method of fabricating comprising the steps of providing a sensor chip assembly and mounting platform (items 20 and 30), positioning the sensor chip in facing by spaced apart relation to the mounting platform (see, for example, figure 4), and placing a bonding medium between

the sensor chip assembly and the mounting platform (item 40). Salatino discloses that the bonding medium comprises at least two malleable particles (items 37 and 38), and a quantity of uncured adhesive (see column 4, lines 30-40, which describe the film as being a thermoplastic transparent film - uncured adhesive comprises thermoplastic materials). Particles 37 and 38 are clearly intended to be spherical : note that one circular element 37 mates with each pair of the square elements of 21 and 31 (see all figures), and are positioned in the thermoplastic. Salatino discloses bonding the sensor chip to the mounting platform (see column 4, lines 44-46, which discloses bonding the sensor chip to the mounting platform). Salatino is silent as to the apparatus that bonds the two structures together, except to mention that the apparatus is a convention DCA (direct chip attachment) device (column 4, lines 46-50), and that any conventional DCA apparatus is intended to be used for the creation of the sensor chip assembly. Salatino also discloses that the heating occurs after the joining, i.e. pressing steps (see either Figure 1 or Figure 9. In Figure 1, pressing/joining occurs at step 14 and heating occurs afterwards at step 15. Similarly, in Figure 9, pressing joining occurs at step 63 and heating occurs at step 64. In both flowcharts there is a preliminary heating step that occurs prior to the joining of the sensor and the platform - however, this heating steps attaches the film to the sensor, and occurs prior to any joining of the sensor and platform, and this step is not excluded by the current claimed method).

Salatino can be interpreted as being silent as to the shape of the malleable spheres, whether the material used is a metal that bonds to both components when subjected to sufficiently large force, the type of material used for the malleable spheres,

and the specific steps and details of using the bonding apparatus (i.e., does not disclose the bonding apparatus in detail with the steps of monitoring, controlling, and curing.) Furthermore, Salatino discloses only as a preferred embodiment as using thermoplastic adhesives, which do not cure under heat. However, Salatino does disclose that the thermoplastic can be replaced by other known materials (see columm 4, lines 7-10 and lines 30-40). Furthermore, Salatino does not disclose removing the assembly from the bonding apparatus prior to full curing of the adhesive.

Schar discloses that it is known to use a thermoset with the metal malleable spheres. Schar discloses several curable adhesives such as silicones (see column 5, lines 47-64). Schar also discloses curing the metal-thermoset combination after the bonding stage, and suggests that this can be done in order to provide the capability to subsequently repair the substrates (column 3, lines 59-65). One in the art would appreciate that this thermoplastic can replace the thermoplastic of Salatino if a more permanent, cured bond is desired, that is less vulnerable to subsequent heat. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized a thermoset adhesive which would cure instead of simply heat under the heating phases in order to achieve a bond that is not vulnerable to misalignment if subsequently subjected to heat. Furthermore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have used a subsequent cure step in order to provide a repair capability prior to final curing.

Chiu discloses a bonding method for semiconductor bonding wherein malleable spheres are used, and the spheres are made of gold. Chiu uses these gold spheres in

a sphere and adhesive bonding layer (see Figures 2a-2e). Chiu discloses that gold is particularly useful for making contacts to aluminum contacts on a semiconductor chip. Chiu also discloses that the gold spheres are positioned in the adhesive mix. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized gold spheres as the contact material in order to make highly efficient conductive pathways on conventional aluminum contacts.

Sato discloses a conventional DCA apparatus for apply a chip to a platform. Sato discloses pressing the first element into the second element, with sufficient force to bond the bonding material such that the two elements are bonded. Sato also discloses monitoring the forces of the bonding reaction and controlling the force of the bonding apparatus responsive to the monitoring. Sato discloses a load sensor (item 33) which is operable to control the reaction force, i.e., compression force (see column 4, lines 15-30). This load sensor feeds back information which controls the compression force. One in the art would appreciate that Sato would fit as the conventional DCA apparatus recited in Salatino, and further includes benefits of controlling the pressing function in order to properly bond the article. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the bonding apparatus and control methods for generalized semiconductor component bonding as in Sato with the overall sensor assembly bonding method and article of Salatino in order to properly control the joining step of Salatino which occurs prior to curing the adhesive.

Freeman discloses that it is known for a DCA apparatus to press and join the adhesives and then remove the pressing and commence a curing operation (see

column 9, line 67 to column 10, line 2), in other words, removing the assembly from the bonding apparatus prior to full curing of the adhesive. One in the art would immediately appreciate that Freeman does this in order to increase throughput by eliminating "downtime" at the various stations. Freeman does this by several items sequentially, and then curing them all together, improving throughput. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have removed the assembly from the bonding apparatus prior to full curing of the adhesive as in Freeman in order to improve production throughput.

6. Claims 9, 18 and 20 are further rejected under 35 U.S.C. 103(a) as being unpatentable over Salatino, Schar, Chiu and Sato as applied to claims 1, 11 above, or Salatino, Schar, Chiu, Sato and Freeman as applied to claim 20 above, and further in view of McArdle (US Patent 6,423,172 B1) or Insaka (US 5,460,667).

Salatino, Chiu, and Sato as applied to claims 1, 11, and 20 do not disclose the use of the additional Markush group member material of tin, germanium and indium for the malleable spheres. Salatino, Chiu and Sato merely provide support for the material of gold.

McArdle discloses using indium based solders, i.e., spheres, due to benefits when the solder is to be wavecoated over a previously formed gold coating. McArdle discloses that the use of indium has many advantages such as enhanced wetting and aging properties (column 8, lines 25-30). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have used indium as it provides

enhanced wetting and aging properties. McArdle also discloses that gold and tin are known bonding solders (see column 8, lines 9-24).

Insaka discloses using Germanium and Tin as part of solder compositions. Insaka discloses an 80-20 wt% gold/tin composition and an 88/12 wt% gold-germanium composition as solder choices for the malleable spheres. One would appreciate that the proper composition would be selected based on the choice of materials used in the first and second components. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use tin and germanium as the malleable sphere metals.

Response to Arguments

7. Applicant's arguments filed 11/30/2003, with respect to claims 1-19 have been fully considered but they are not persuasive.

8. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

9. Furthermore, applicant argues that the passage in column 4, lines 30-40 of Salatino, which recites "those of skill in the art will recognize that other methods of securing or adhesively securing the film to the chip and to the carrier are also contemplated by the present invention" does not mean what the plain English recites:

that one of skill in the art could use other adhesive methods, such as those in Schar, Chiu, etc. This argument is considered completely unpersuasive. Applicant's entire remarks are directed towards arguing that it would not have been obvious to use other adhesive securing methods known in the art (such as those of Schar) even though the primary reference specifically contemplates doing so.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection for claim 20 presented in this Office action. The other rejections are maintained. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George R. Koch III whose telephone number is (571)

272-1230 (TDD only). If the applicant cannot make a direct TDD-to-TDD call, the applicant can communicate by calling the Federal Relay Service at 1-800-877-8339 and giving the operator the above TDD number. The examiner can normally be reached on M-Th 10-7.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Crispino can be reached on (571) 272-1226. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

George R. Koch III
February 28, 2004

RICHARD CRISPINO
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